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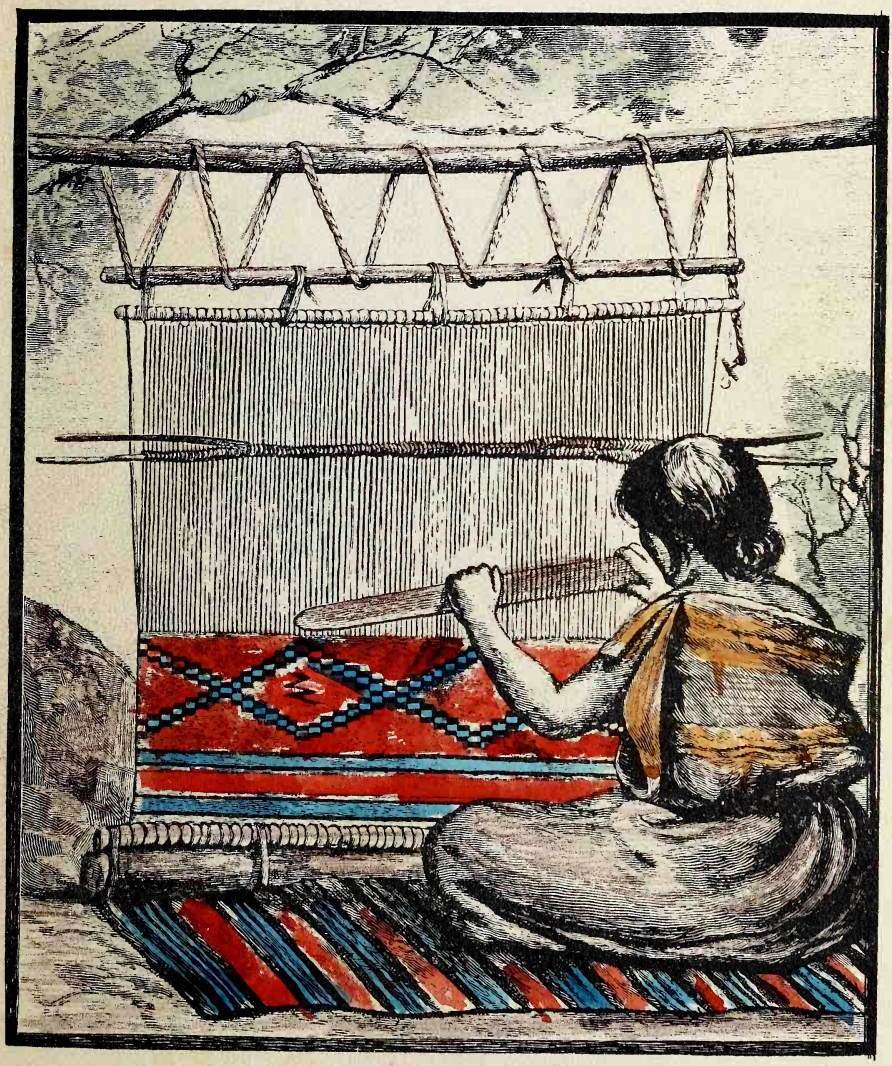
NAVAJO WEAVERS

NAVAJO SILVERSMITHS

Museum of Indian Heritage
6040 DeLong Road
Eagle Creek Park
Indianapolis, Ind. 46234

BY

Dr. WASHINGTON MATTHEWS, U. S. A.



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NAVAJO WEAVERS

NAVAJO SILVERSMITHS

BY

Dr. WASHINGTON MATTHEWS, U. S. A.

FILTER PRESS
Palmer Lake, Colorado
1968

Wild & Woolly West Books

1. Choda Thirty Pound Rails
2. Clemens Celebrated Jumping Frog
3. Banks Uncle Jim's Pancakes
4. Service Yukon Poems
5. Cushing My Adventures in Zuni
6. Englert Oliver Perry Wiggins
7. Matthews Navajo Weavers & Silversmiths
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11. Rusho Powell's Canyon Voyage
12. Hinckley Transcontinental Rails
13. Young The Grand Canyon

Margaret Henry of Farmington, New Mexico, has followed a practice that was common during the Victorian Era by hand tinting the wood engraving on the cover of this booklet.

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PUBLISHER'S NOTE

We in the Twentieth Century are indeed fortunate that the early "Expeditions of Exploration" of the American West had skillful illustrators. Many of the men who became notable illustrators and writers were assigned to the expeditions as physicians and surgeons. The sketches of Dr. William H. Holmes remain among the most attractive records of the Grand Canyon as it was. Other doctors not only were good illustrators (with skill acquired as part of their medical training), but they became competent botanists, zoologists, geologists, and anthropologists by utilizing the observational processes important to them in their medical work. Their main duties were as physicians and surgeons, but they were expected to follow other scientific work and report on it. Fortunately there seemed to have been ample time for them to record their observations for us.

Dr. Washington Matthews, the author of the two papers presented here, made his greatest contributions while he was an assistant surgeon in the U.S. Army stationed at posts in the Indian reservations. While he was attached to the garrison at Fort Wingate, New Mexico Territory, he did the field work resulting in these papers and the Mountain Chant of the Navajos.

Washington Matthews, the son of Dr. Nicholas Blaney Matthews and Anna Burke Matthews, was born near Dublin, Ireland in 1843. While he was a young boy he lost his mother, and was brought to America by his father. They settled in Wisconsin, and later in Iowa, where the father continued his practice of medicine. Young Matthews worked as a medical apprentice to his father and entered the University of Iowa, where he received his M.D. in 1864. He entered the Union Army to serve until the end of the Civil War. In the summer of 1865 he was again commissioned, and served as an assistant surgeon in Dakota Territory. Here he began his studies in anthropology. He returned to the Easton a military assignment, and following a tour of duty in California, was sent to Fort Wingate.

He had already established his reputation as a serious ethnographer by his Grammar and Dictionary of the Language of the Hidatsa (1873) and his Ethnography and Philology of the Hidatsa Indians (1877). Navajo Silversmiths was published in the Second Report of the Bureau of Ethnology for 1880-1881, and Navajo Weavers was published in the Third Report for 1881-1882. In introducing these reports Major John W. Powell, Director of the Bureau gratefully acknowledged Matthews' "sparing time from his official duties to continue his studies of the Indian tribes accessible to his post." Thus began a long and profitable association resulting in publication of many of his works in BAE reports and bulletins.

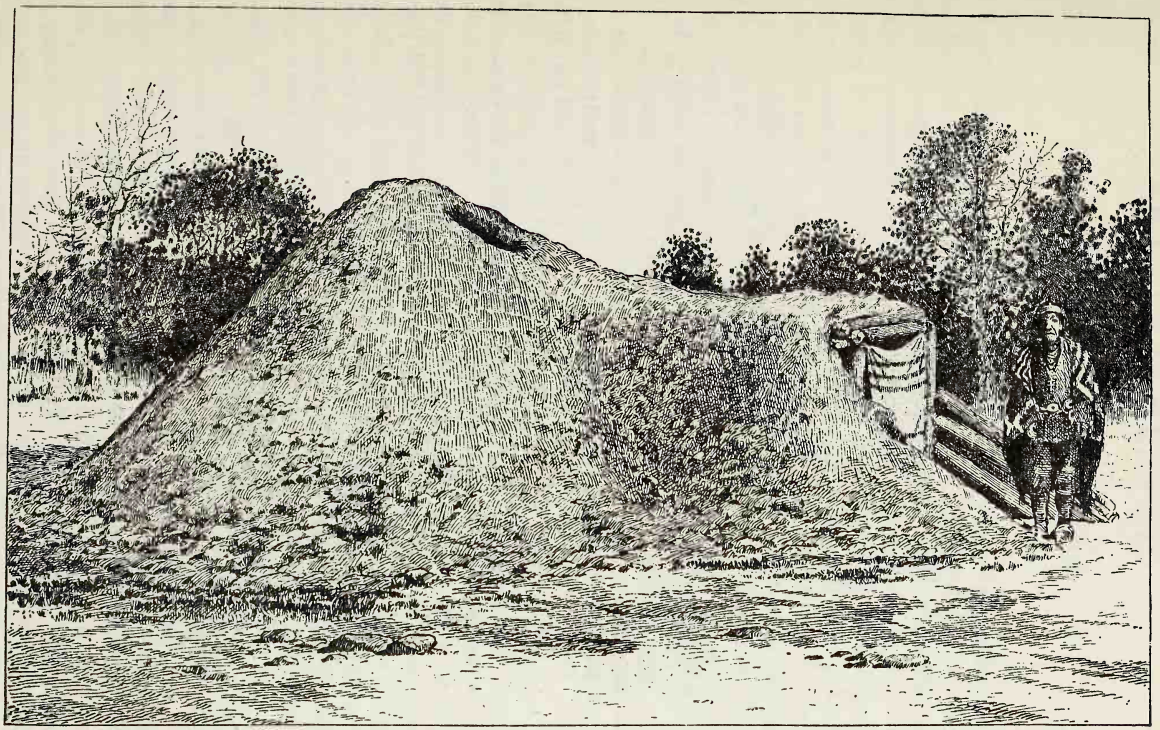
Until his death in 1905 Dr. Matthews continued to work in a dual capacity. He was first a surgeon and physician, yet is remembered as an anthropologist and explorer. For a time he was Assistant Curator of the Army Medical Museum. He wrote extensively for the Smithsonian Institution and the Bureau of American Ethnology. He was the inventor of a number of devices that helped develop cranial measurements as an exact tool of physical anthropologists. Like the other explorers of his time, he helped bridge the gap between history and the present.

In Navajo Silversmiths Dr. Matthews describes the equipment and processes of the Navajos, and gives the history of their learning the craft, apparently first learned as brass smithing from sedentary Indians who learned from the Spanish explorers. By the time of the Matthews study the Navajos had returned to their homeland from Fort Sumner, and were living as reservation Indians, uprooted from their earlier life patterns, and from their enforced idleness as captives. Their silversmithing had advanced to the point of using European tools and equipment for cutting and polishing. However welding and silver soldering of small pieces was done on a simple coal or charcoal fired forge. To those of us who have ruined silver work with much more easily controlled heat, this is evidence of truly great patience and skill! Matthews' comments on the waste of silver scrap are especially interesting today in view of the serious shortage of the metal.

He continued his study of crafts in Navajo Weavers. It again appears that some of the skill was acquired from the Spanish through the Pueblo Indians. There is some evidence that weaving had been developed much earlier, using cotton, yucca, animal hair and feathers. The early wool was obtained from fabrics made by Europeans, and patiently reduced to yarns that were colored to suit Navajo tastes. Various types of looms were used for different work, and local materials produced the dyes that once lost favor, but have been revived for the modern market. Of the numerous looms once used, only what is now considered the "Traditional loom" is widely used.

Because Dr. Matthews refers to the plates by number in the text we have left the original plate numbers in their old position and order. Numbers preceding these referred to other papers in the original volumes. The text and illustrations of the two articles in this booklet are facsimile reproductions of the works as first published. In addition we have used sketches by Dr. William H. Holmes to show the Navajo hogans as they were constructed then. A few of these forked stick hogans can be seen in the Navajo country where they are being replaced rapidly. We feel it is appropriate that the first complete facsimile of these papers be issued in 1968, the Centennial of the Long Walk of the Navajos from Fort Sumner to their homeland. The Navajo tribe regards the Long Walk as the beginning of their life as a modern nation.

G.L. Campbell, Publisher
Palmer Lake, June, 1968



MEDICINE LODGE, VIEWED FROM THE SOUTH.

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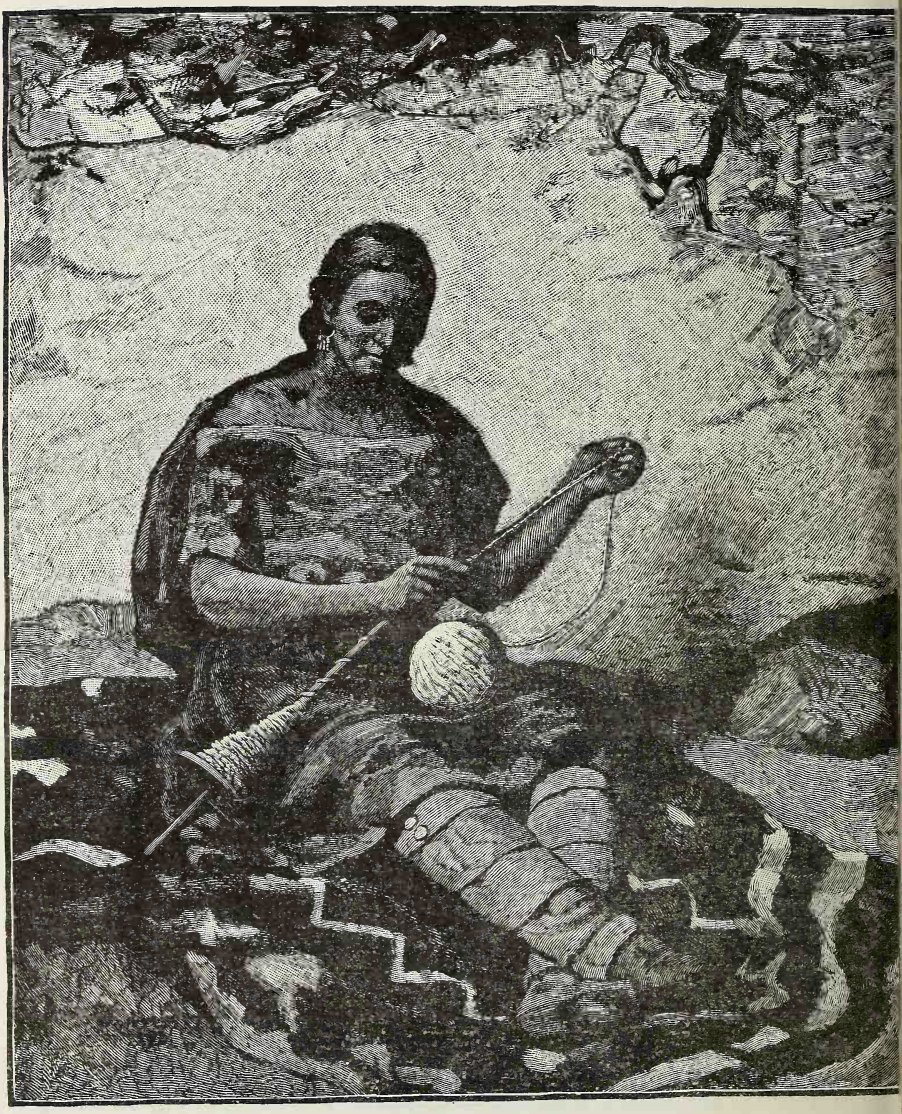
NAVAJO WEAVERS.

By Dr. Washington Matthews.

§ I. The art of weaving, as it exists among the Navajo Indians of New Mexico and Arizona, possesses points of great interest to the student of ethnography. It is of aboriginal origin; and while European art has undoubtedly modified it, the extent and nature of the foreign influence is easily traced. It is by no means certain, still there are many reasons for supposing, that the Navajos learned their craft from the Pueblo Indians, and that, too, since the advent of the Spaniards; yet the pupils, if such they be, far excel their masters to-day in the beauty and quality of their work. It may be safely stated that with no native tribe in America, north of the Mexican boundary, has the art of weaving been carried to greater perfection than among the Navajos, while with none in the entire continent is it less Europeanized. As in language, habits, and opinions, so in arts, the Navajos have been less influenced than their sedentary neighbors of the pueblos by the civilization of the Old World.

The superiority of the Navajo to the Pueblo work results not only from a constant advance of the weaver's art among the former, but from a constant deterioration of it among the latter. The chief cause of this deterioration is that the Pueblos find it more remunerative to buy, at least the finer *serapes*, from the Navajos, and give their time to other pursuits, than to manufacture for themselves; they are nearer the white settlements and can get better prices for their produce; they give more attention to agriculture; they have within their country, mines of turquoise which the Navajos prize, and they have no trouble in procuring whisky, which some of the Navajos prize even more than gems. Consequently, while the wilder Indian has incentives to improve his art, the more advanced has many temptations to abandon it altogether. In some pueblos the skill of the loom has been almost forgotten. A growing fondness for European clothing has also had its influence, no doubt.

§ II. Cotton, which grows well in New Mexico and Arizona, the tough fibers of yucca leaves and the fibers of other plants, the hair of different quadrupeds, and the down of birds furnished in prehistoric days the materials of textile fabrics in this country. While some of the Pueblos still weave their native cotton to a slight extent, the Navajos grow no cotton and spin nothing but the wool of the domestic sheep, which animal is, of course, of Spanish introduction, and of which the Navajos have vast herds.



NAVAJO WOMAN SPINNING.

The wool is not washed until it is sheared. At the present time it is combed with hand cards purchased from the Americans. In spinning, the simplest form of the spindle—a slender stick thrust through the center of a round wooden disk—is used. The Mexicans on the Rio Grande use spinning-wheels, and although the Navajos have often seen these wheels, have had abundant opportunities for buying and stealing them, and possess, I think, sufficient ingenuity to make them, they have never abandoned the rude implement of their ancestors. Plate XXXIV illustrates the Navajo method of handling the spindle, a method different from that of the people of Zuñi.

They still employ to a great extent their native dyes: of yellow, reddish, and black. There is good evidence that they formerly had a blue dye; but indigo, originally introduced, I think, by the Mexicans, has superseded this. If they, in former days, had a native blue and a native yellow, they must also, of course, have had a green, and they now make green of their native yellow and indigo, the latter being the only imported dye-stuff I have ever seen in use among them. Besides the hues above indicated, this people have had, ever since the introduction of sheep, wool of three different natural colors—white, rusty black, and gray—so they had always a fair range of tints with which to execute their artistic designs. The brilliant red figures in their finer blankets were, a few years ago, made entirely of *bayeta*, and this material is still largely used. Bayeta is a bright scarlet cloth with a long nap, much finer in appearance than the scarlet strouding which forms such an important article in the Indian trade of the North. It was originally brought to the Navajo country from Mexico, but is now supplied to the trade from our eastern cities. The Indians ravel it and use the weft. While many handsome blankets are still made only of the colors and material above described, American yarn has lately become very popular among the Navajos, and many fine blankets are now made wholly, or in part, of Germantown wool.

The black dye mentioned above is made of the twigs and leaves of the aromatic sumac (*Rhus aromatica*), a native yellow ocher, and the gum of the piñon (*Pinus edulis*). The process of preparing it is as follows: They put into a pot of water some of the leaves of the sumac, and as many of the branchlets as can be crowded in without much breaking or crushing, and the water is allowed to boil for five or six hours until a strong decoction is made. While the water is boiling they attend to other parts of the process. The ocher is reduced to a fine powder between two stones and then slowly roasted over the fire in an earthen or metal vessel until it assumes a light-brown color; it is then taken from the fire and combined with about an equal quantity in size of piñon gum; again the mixture is put on the fire and constantly stirred. At first the gum melts and the whole mass assumes a mushy consistency; but as the roasting progresses it gradually becomes drier and darker until it is at last reduced to a fine black powder. This is removed from the

fire, and when it has cooled somewhat it is thrown into the decoction of sumac, with which it instantly forms a rich, blue-black fluid. This dye is essentially an ink, the tannic acid of the sumac combining with the sesquioxide of iron in the roasted ocher, the whole enriched by the carbon of the calcined gum.

There are, the Indians tell me, three different processes for dyeing yellow; two of these I have witnessed. The first process is thus conducted: The flowering tops of *Bigelovia graveolens* are boiled for about six hours until a decoction of deep yellow color is produced. When the dyer thinks the decoction strong enough, she heats over the fire in a pan or earthen vessel some native almogen (an impure native alum), until it is reduced to a somewhat pasty consistency; this she adds gradually to the decoction and then puts the wool in the dye to boil. From time to time a portion of the wool is taken out and inspected until (in about half an hour from the time it is first immersed) it is seen to have assumed the proper color. The work is then done. The tint produced is nearly that of lemon yellow. In the second process they use the large, fleshy root of a plant which, as I have never yet seen it in fruit or flower, I am unable to determine. The fresh root is crushed to a soft paste on the *metate*, and, for a mordant, the almogen is added while the grinding is going on. The cold paste is then rubbed between the hands into the wool. If the wool does not seem to take the color readily a little water is dashed on the mixture of wool and paste, and the whole is very slightly warmed. The entire process does not occupy over an hour and the result is a color much like that now known as "old gold."

The reddish dye is made of the bark of *Alnus incana* var. *virescens* (Watson) and the bark of the root of *Cercocarpus parvifolius;* the mordant being fine juniper ashes. On buckskin this makes a brilliant tan-color; but applied to wool it produces a much paler tint.

§ III. Plate XXXVIII and Fig. 42 illustrate ordinary blanket-looms. Two posts, *a a*, are set firmly in the ground; to these are lashed two cross-pieces or braces, *b c*, the whole forming the frame of the loom. Sometimes two slender trees, growing at a convenient distance from one another, are made to answer for the posts. *d* is a horizontal pole, which I call the supplementary yarn-beam, attached to the upper brace, *b*, by means of a rope, *e e*, spirally applied. *f* is the upper beam of the loom. As it is analogous to the yarn-beam of our looms, I will call it by this name, although once only have I seen the warp wound around it. It lies parallel to the pole *d*, about 2 or 3 inches below it, and is attached to the latter by a number of loops, *g g*. A spiral cord wound around the yarn-beam holds the upper border cord *h h*, which, in turn, secures the upper end of the warp *i i*. The lower beam of the loom is shown at *k*. I will call this the cloth-beam, although the finished web is never wound around it; it is tied firmly to the lower brace, *c*, of the frame, and to it is secured the lower border cord of the blanket. The original distance between the two beams is the length of the blanket. Lying

between the threads of the warp is depicted a broad, thin, oaken stick, *l*, which I will call the batten. A set of healds attached to a heald-

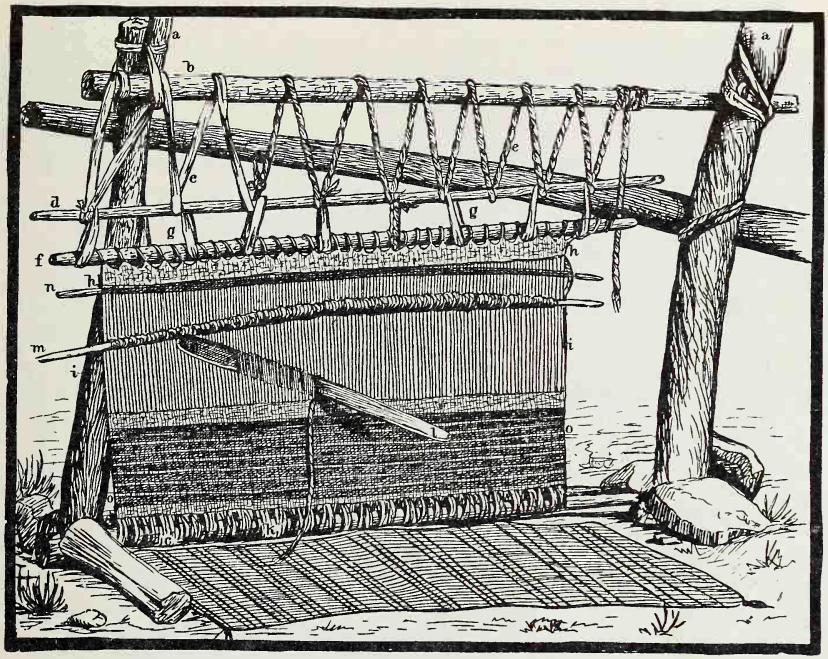


FIG. 42.—Ordinary Navajo blanket loom.

rod, *m*, are shown above the batten. These healds are made of cord or yarn; they include alternate threads of the warp, and serve when drawn forward to open the lower shed. The upper shed is kept patent by a stout rod, *n* (having no healds attached), which I name the shed-rod. Their substitute for the reed of our looms is a wooden fork, which will be designated as the reed-fork (Fig. 44, *a*).

For convenience of description, I am obliged to use the word "shuttle," although, strictly speaking, the Navajo has no shuttle. If the figure to be woven is a long stripe, or one where the weft must be passed through 6 inches or more of the shed at one time, the yarn is wound on a slender twig or splinter, or shoved through on the end of such a piece of wood; but where the pattern is intricate, and the weft passes at each turn through only a few inches of the shed, the yarn is wound into small skeins or balls and shoved through with the finger.

§ IV. The warp is thus constructed: A frame of four sticks is made, not unlike the frame of the loom, but lying on or near the ground, instead of standing erect. The two sticks forming the sides of the frame are rough saplings or rails; the two forming the top and bottom are smooth rounded poles—often the poles which afterwards serve as the beams of the loom; these are placed parallel to one another, their distance apart depending on the length of the projected blanket.

On these poles the warp is laid in a continuous string. It is first firmly tied to one of the poles, which I will call No. 1 (Fig. 43); then it is passed over the other pole, No. 2, brought back under No. 2 and over No. 1, forward again under No. 1 and over No. 2, and so on to the end. Thus the first, third, fifth, &c., turns of the cord cross in the middle the second, fourth, sixth, &c., forming a series of elongated figures 8, as shown in the following diagram—

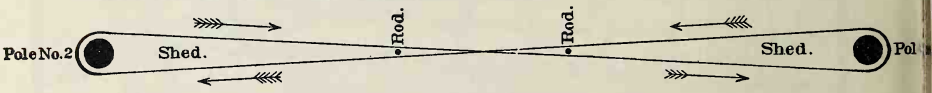


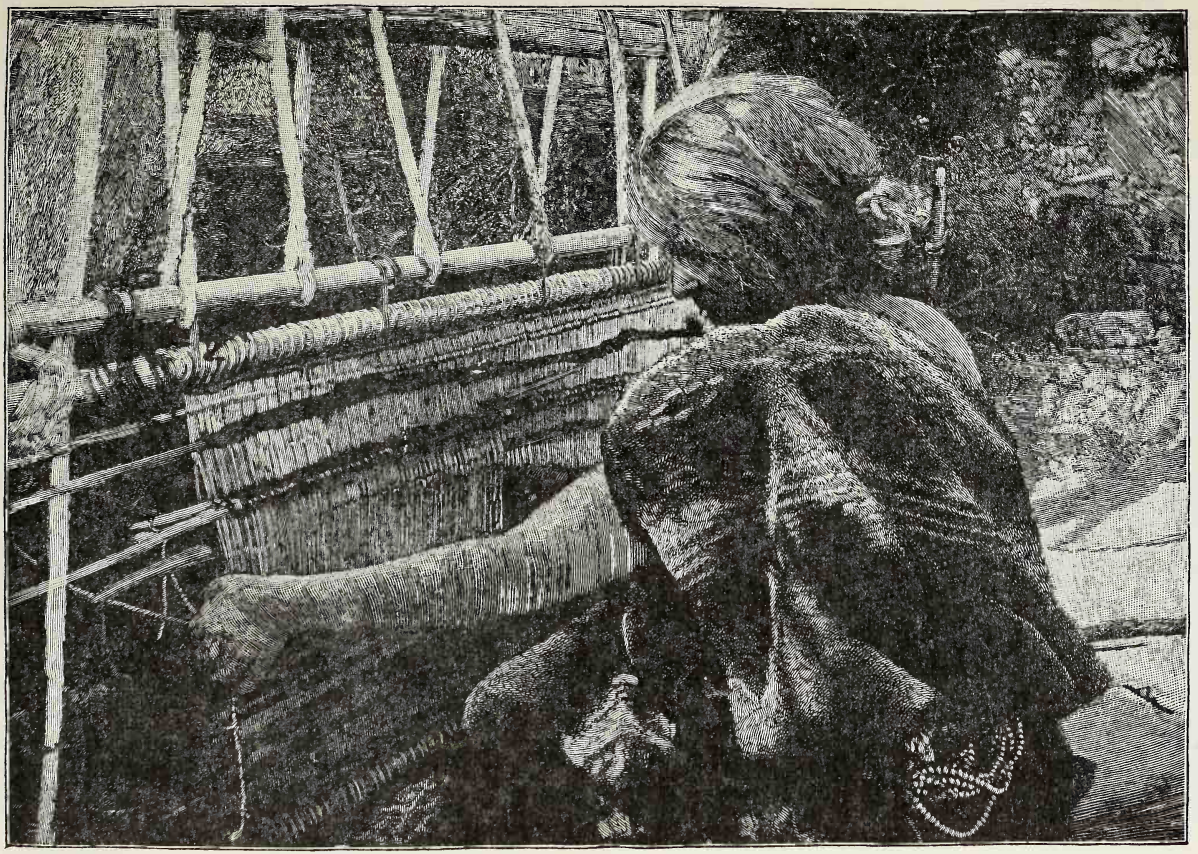
FIG. 43.—Diagram showing formation of warp.

and making, in the very beginning of the process, the two sheds, which are kept distinct throughout the whole work. When sufficient string has been laid the end is tied to pole No. 2, and a rod is placed in each shed to keep it open, the rods being afterwards tied together at the ends to prevent them from falling out.

This done, the weaver takes three strings (which are afterwards twilled into one, as will appear) and ties them together at one end. She now sits outside of one of the poles, looking toward the center of the frame, and proceeds thus: (1) She secures the triple cord to the pole immediately to the left of the warp; (2) then she takes one of the threads (or strands as they now become) and passes it under the first turn of the warp; (3) next she takes a second strand, and twilling it once or oftener with the other strands, includes with it the second bend of the warp; (4) this done, she takes the third strand and, twilling it as before, passes it under the third bend of the warp, and thus she goes on until the entire warp in one place is secured between the strands of the cord; (5) then she pulls the string to its fullest extent, and in doing so separates the threads of the warp from one another; (6) a similar three stranded cord is applied to the other end of the warp, along the outside of the other pole.

At this stage of the work these stout cords lie along the outer surfaces of the poles, parallel with the axes of the latter, but when the warp is taken off the poles and applied to the beams of the loom by the spiral thread, as above described, and as depicted in Plate XXXVIII and Fig. 42, and all is ready for weaving, the cords appear on the inner sides of the beams, *i. e.*, one (Pl. XXXVIII and Fig. 42, *h h*) at the lower side of the yarn-beam, the other at the upper side of the cloth-beam, and when the blanket is finished they form the stout end margins of the web. In the coarser grade of blankets the cords are removed and the ends of the warp tied in pairs and made to form a fringe. (See Figs. 54 and 55.)

When the warp is transferred to the loom the rod which was placed in the upper shed remains there, or another rod, straighter and smoother,



WEAVING OF DIAMOND-SHAPED DIAGONALS.

is substituted for it; but with the lower shed, healds are applied to the anterior threads and the rod is withdrawn.

§ V. The mode of applying the healds is simple: (1) the weaver sits facing the loom in the position for weaving; (2) she lays at the right (her right) side of the loom a ball of string which she knows contains more than sufficient material to make the healds; (3) she takes the end of this string and passes it to the left through the shed, leaving the ball in its original position; (4) she ties a loop at the end of the string large enough to admit the heald-rod; (5) she holds horizontally in her left hand a straightish slender rod, which is to become the heald-rod—its right extremity touching the left edge of the warp—and passes the rod through the loop until the point of the stick is even with the third (second anterior from the left) thread of the warp; (6) she puts her finger through the space between the first and third threads and draws out a fold of the heald-string; (7) she twists this once around, so as to form a loop, and pushes the point of the heald-rod on to the right through this loop; (8) she puts her finger into the next space and forms another loop; (9) and so on she continues to advance her rod and form her loops from left to right until each of the anterior (alternate) warp-threads of the lower shed is included in a loop of the heald; (10) when the last loop is made she ties the string firmly to the rod near its right end.

When the weaving is nearly done and it becomes necessary to remove the healds, the rod is drawn out of the loops, a slight pull is made at the thread, the loops fall in an instant, and the straightened string is drawn out of the shed. Illustrations of the healds may be seen in Plates XXXV and XXXVIII and Figs. 42, 44, and 46, that in Fig. 46 being the most distinct.

§ VI. In making a blanket the operator sits on the ground with her legs folded under her. The warp hangs vertically before her, and (excepting in a case to be mentioned) she weaves from below upwards. As she never rises from this squatting posture when at work, it is evident that when she has woven the web to a certain height further work must become inconvenient or impossible unless by some arrangement the finished web is drawn downwards. Her cloth-beam does not revolve as in our looms, so she brings her work within easy reach by the following method: The spiral rope (Plate XXXVIII and Fig. 42) is loosened, the yarn-beam is lowered to the desired distance, a fold is made in the loosened web, and the upper edge of the fold is sewed down tightly to the cloth-beam. In all new blankets over two feet long the marks of this sewing are to be seen, and they often remain until the blanket is worn out. Plate XXXV, representing a blanket nearly finished, illustrates this procedure.

Except in belts, girths, and perhaps occasionally in very narrow blankets, the shuttle is never passed through the whole width of the warp at once, but only through a space which does not exceed the length of the batten; for it is by means of the batten, which is rarely more than 3 feet long, that the shed is opened.

Suppose the woman begins by weaving in the lower shed. She draws a portion of the healds towards her, and with them the anterior threads of the shed; by this motion she opens the shed about 1 inch, which is not sufficient for the easy passage of the woof. She inserts her batten edgewise into this opening and then turns it half around on its long axis, so that its broad surfaces lie horizontally; in this way the shed is opened to the extent of the width of the batten—about 3 inches; next the weft is passed through. In fig. 42 the batten is shown lying edgewise (its broad surfaces vertical), as it appears when just inserted into the shed, and the weft, which has been passed through only a portion of the shed, is seen hanging out with its end on the ground. In Plate XXXV the batten is shown in the second position described, with the shed open to the fullest extent necessary, and the weaver is represented in the act of passing the shuttle through. When the weft is in, it is shoved down into its proper position by means of the reed-fork, and then the batten, restored to its first position (edgewise), is brought down with firm blows on the weft. It is by the vigorous use of the batten that the Navajo serapes are rendered water-proof. In Plate XXXVIII the weaver is seen bringing down this instrument "in the manner and for the purpose described," as the letters patent say.

When the lower shed has received its thread of weft the weaver opens the upper shed. This is done by releasing the healds and shoving the shed-rod down until it comes in contact with the healds; this opens the upper shed down to the web. Then the weft is inserted and the batten and reed-fork used as before. Thus she goes on with each shed alternately until the web is finished.

It is, of course, desirable, at least in handsome blankets of intricate pattern, to have both ends uniform even if the figure be a little faulty in the center. To accomplish this some of the best weavers depend on a careful estimate of the length of each figure before they begin, and weave continuously in one direction; but the majority weave a little portion of the upper end before they finish the middle. Sometimes this is done by weaving from above downwards; at other times it is done by turning the loom upside down and working from below upwards in the ordinary manner. In Fig. 49, which represents one of the very finest results of Navajo work, by the best weaver in the tribe, it will be seen that exact uniformity in the ends has not been attained. The figure was of such a nature that the blanket had to be woven in one direction only.

I have described how the ends of the blanket are bordered with a stout three-ply string applied to the folds of the warp. The lateral edges of the blanket are similarly protected by stout cords applied to the weft. The way in which these are woven in, next demands our attention. Two stout worsted cords, tied together, are firmly attached at each end of the cloth-beam just outside of the warp; they are then carried upwards and loosely tied to the yarn-beam or the supplementary

yarn-beam. Every time the weft is turned at the edge these two strings are twisted together and the weft is passed through the twist; thus one thread or strand of this border is always on the outside. As it is constantly twisted in one direction, it is evident that, after a while, a counter-twist must form which would render the passage of the weft between the cords difficult, if the cords could not be untwisted again. Here the object of tying these cords loosely to one of the upper beams, as before described, is displayed. From time to time the cords are untied and the unwoven portion straightened as the work progresses. Fig. 44 and Plate XXXVIII show these cords. The coarse blankets do not have them. (Fig 42.)

Navajo blankets are single-ply, with designs the same on both sides, no matter how elaborate these designs may be. To produce their varigated patterns they have a separate skein, shuttle, or thread for each component of the pattern. Take, for instance, the blanket depicted in Fig. 49. Across this blanket, between the points *a*—*b*, we have two serrated borders, two white spaces, a small diamond in the center, and twenty-four serrated stripes, making in all twenty-nine component parts of the pattern. Now, when the weaver was working in this place, twenty-nine different threads of weft might have been seen hanging from the face of the web at one time. In the girth pictured in Fig. 44 five different threads of woof are shown depending from the loom.

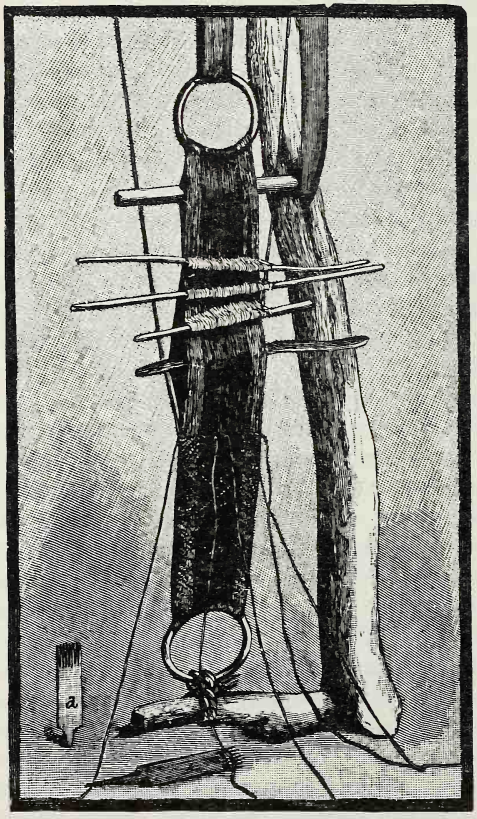


FIG. 44.—Weaving of saddle-girth.

When the web is so nearly finished that the batten can no longer be inserted in the warp, slender rods are placed in the shed, while the weft is passed with increased difficulty on the end of a delicate splinter and the reed-fork alone presses the warp home. Later it becomes necessary to remove even the rod and the shed; then the alternate threads are separated by a slender stick worked in tediously between them, and two threads of woof are

inserted—one above and the other below the stick. The very last thread is sometimes put in with a darning needle. The weaving of the last three inches requires more labor than any foot of the previous work.

In Figs. 49, 50, 51, 52, and 53 it will be seen that there are small fringes or tassels at the corners of the blankets; these are made of the redundant ends of the four border-cords (*i. e.*, the portions of the cord by which they were tied to the beams), either simply tied together or secured in the web with a few stitches.

The above is a description of the simplest mechanism by which the Navajos make their blankets; but in manufacturing diagonals, sashes, garters, and hair-bands the mechanism is much more complicated.

§ VII. For making diagonals the warp is divided into four sheds; the uppermost one of these is provided with a shed-rod, the others are supplied with healds. I will number the healds and sheds from below upwards. The following diagram shows how the threads of the warp are arranged in the healds and on the rod.

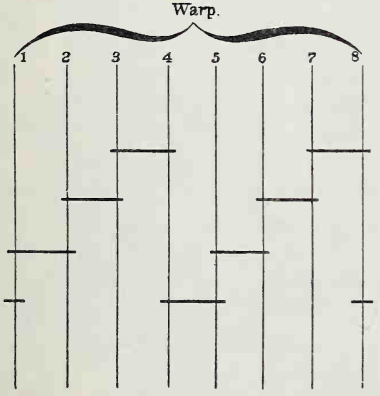


FIG. 45.—Diagram showing arrangement of threads of the warp in the healds and on the rod.

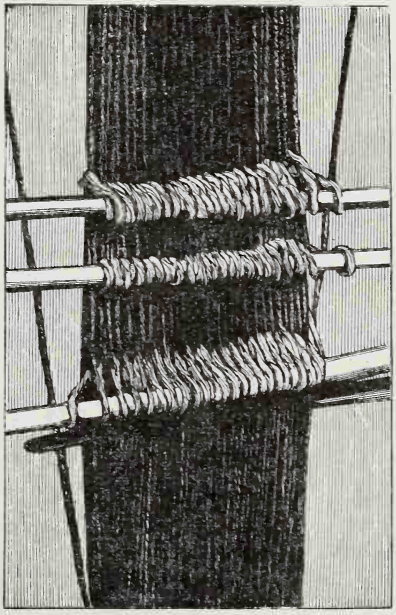


FIG. 46.—Weaving of saddle-girth.

When the weaver wishes the diagonal ridges to run upwards from right to left, she opens the sheds in regular order from below upwards thus: First, second, third, fourth, first, second, third, fourth, &c. When she wishes the ridges to trend in the contrary direction she opens the sheds in the inverse order. I found it convenient to take my illustrations of this mode of weaving from a girth. In Figs. 44 and 46 the mechanism is plainly shown. The lowest (first) shed is opened and the first set of healds drawn forward. The rings of the girth take the place of the beams of the loom.

There is a variety of diagonal weaving practiced by the Navajos which produces diamond figures; for this the mechanism is the same

NAVAJO WOMAN WEAVING A BELT.

as that just described, except that the healds are arranged differently on the warp. The following diagram will explain this arrangement.

To make the most approved series of diamonds the sheds are opened twice in the direct order (*i. e.*, from below upwards) and twice in the

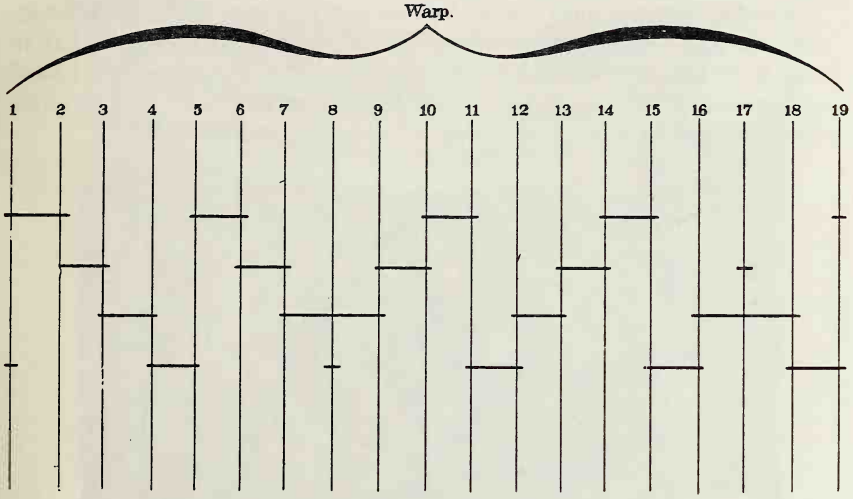


FIG. 47.—Diagram showing arrangement of helds in diagonal weaving.

inverse order, thus: First, second, third, fourth, first, second, third, fourth, third, second, first, fourth, third, second, first, fourth, and so on. If this order is departed from the figures become irregular. If the weaver continues more than twice consecutively in either order, a row

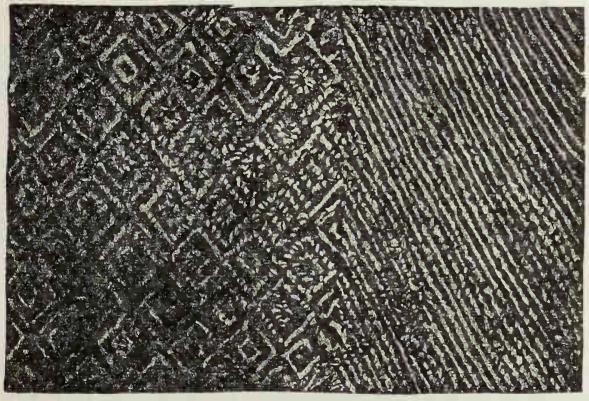


FIG. 48.—Diagonal cloth.

of V-shaped figures is formed, thus: VVVV. Plate XXXV represents a woman weaving a blanket of this pattern, and Fig. 48 shows a portion of a blanket which is part plain diagonal and part diamond.

§ VIII. I have heretofore spoken of the Navajo weavers always as of the feminine gender because the large majority of them are women.

There are, however, a few men who practice the textile art, and among them are to found the best artisans in the tribe.

§ IX. Navajo blankets represent a wide range in quality and finish and an endless variety in design, notwithstanding that all their figures consist of straight lines and angles, no curves being used. As illustrating the great fertility of this people in design I have to relate that in the finer blankets of intricate pattern out of thousands which I have examined, I do not remember to have ever seen two exactly alike. Among the coarse striped blankets there is great uniformity.

FIG. 49.—Navajo blanket of the finest quality.

The accompanying pictures of blankets represent some in my private collection. Fig. 49 depicts a blanket measuring 6 feet 9 inches by 5 feet 6 inches, and weighing nearly 6 pounds. It is made entirely of Germantown yarn in seven strongly contrasting colors, and is the work of a man who is generally conceded to be the best weaver in the tribe. A month was spent in its manufacture. Its figures are mostly in serrated stripes, which are the most difficult to execute with regularity. I have heard that the man who wove this often draws his designs on sand before he begins to work them on the loom. Fig. 50 *a* shows a

blanket of more antique design and material. It is 6 feet 6 inches by 5 feet 3 inches, and is made of native yarn and *bayeta*. Its colors are

FIG. 50.—Navajo blankets.

black, white, dark-blue, red (*bayeta*) and—in a portion of the stair-like figures—a pale blue. Fig. 50 *b* depicts a tufted blanket or rug, of a kind not common, having much the appearance of an Oriental rug; it

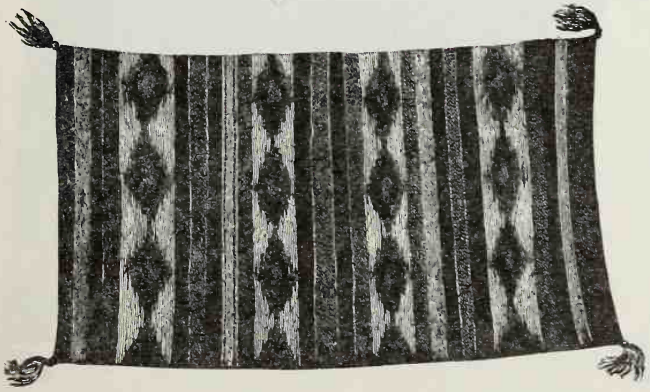


FIG. 51.—Navajo blanket.

is made of shredded red flannel, with a few simple figures in yellow, dark blue, and green. Fig. 51 represents a gaudy blanket of smaller size (5 feet 4 inches by 3 feet 7 inches) worn by a woman. Its colors are

yellow, green, dark blue, gray, and red, all but the latter color being in native yarn. Figs. 52 and 53 illustrate small or half-size blankets made for children's wear. Such articles are often used for saddle

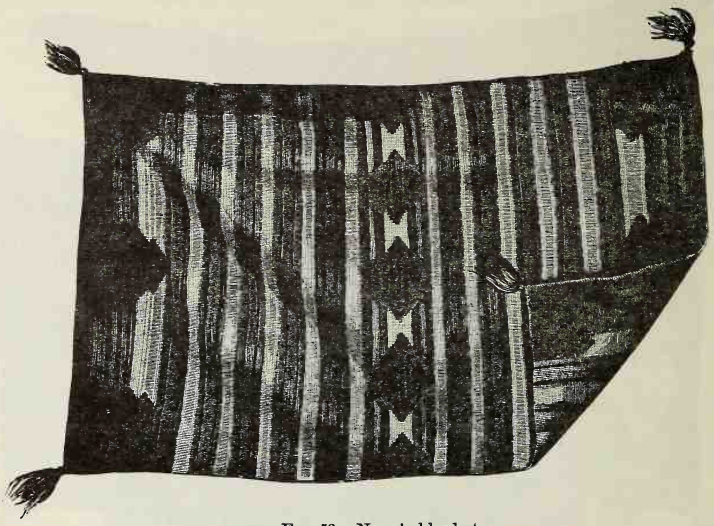


FIG. 52.—Navajo blanket.

blankets (although the saddle-cloth is usually of coarser material) and are in great demand among the Americans for rugs. Fig. 53 has a regular border of uniform device all the way around—a very rare thing

FIG. 53.—Navajo blanket.

in Navajo blankets. Figs. 54 and 55 show portions of coarse blankets made more for use use than ornament. Fig. 55 is made of loosely-twilled yarn, and is very warm but not water-proof. Such blankets

make excellent bedding for troops in the field. Fig. 54 is a water-proof *serape* of well-twilled native wool.

The aboriginal woman's dress is made of two small blankets, equal

FIG. 54.—Part of Navajo blanket.

in size and similar in design, sewed together at the sides, with apertures left for the arms and no sleeves. It is invariably woven in black

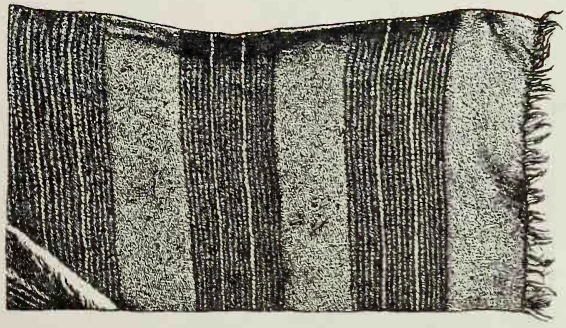


FIG. 55.—Part of Navajo blanket.

or dark-blue native wool with a broad variegated stripe in red imported yarn or red *bayeta* at each end, the designs being of countless

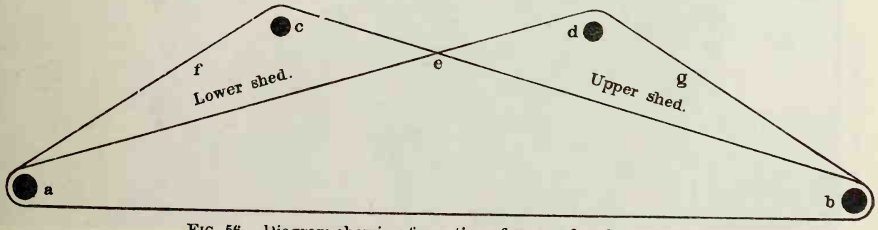
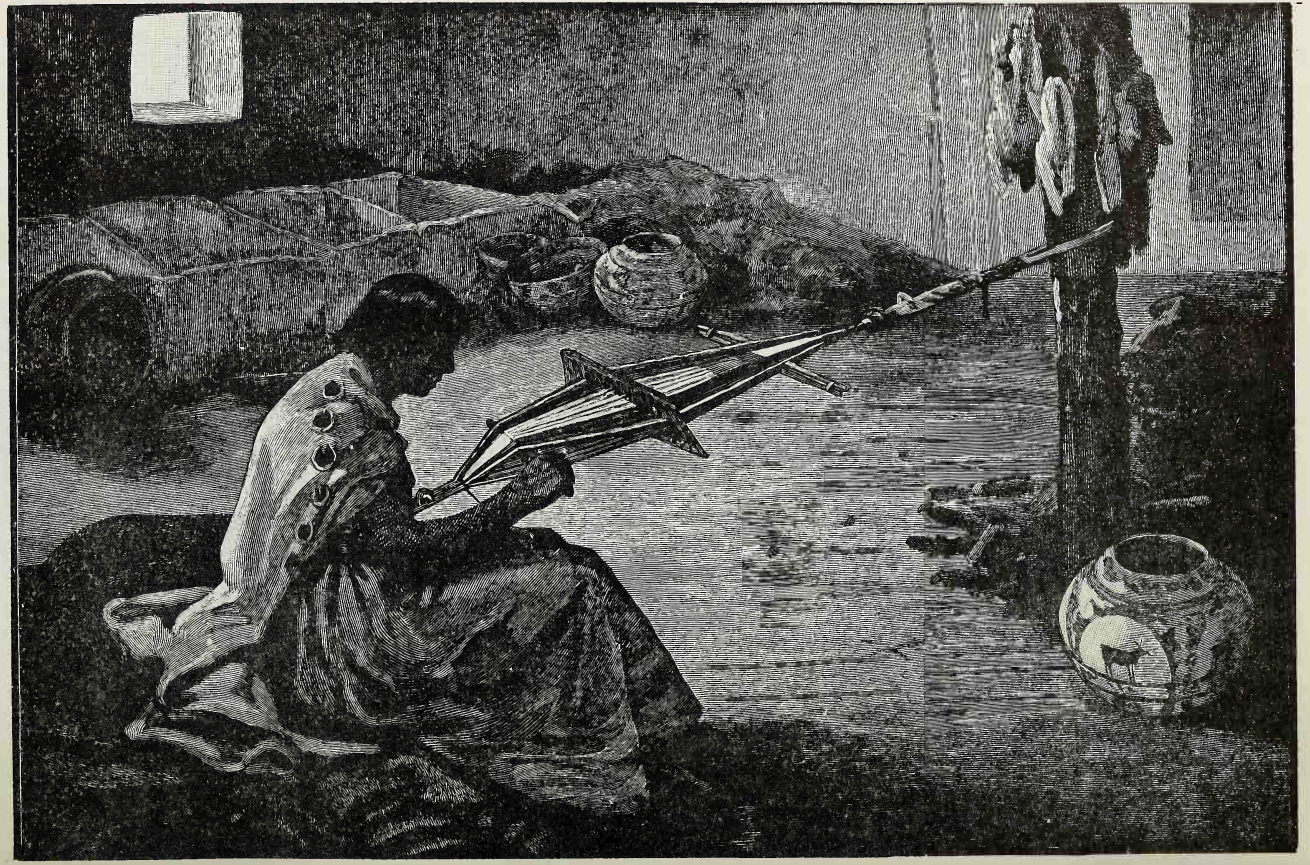


FIG. 56.—Diagram showing formation of warp of sash.

variety. Plates XXXIV and XXXV represent women wearing such dresses.



ZUÑI WOMAN WEAVING A BELT.

§ X. Their way of weaving long ribbon-like articles, such as sashes or belts, garters, and hair-bands, which we will next consider, presents many interesting variations from the method pursued in making blankets. To form a sash the weaver proceeds as follows: She drives into the ground four sticks and on them she winds her warp as a continuous string

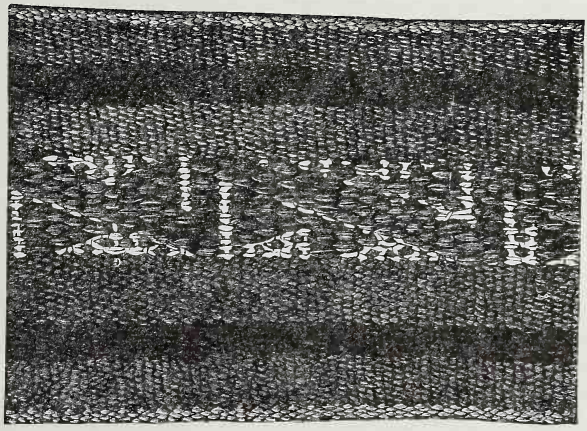


FIG. 57.—Section of Navajo belt.

(however, as the warp usually consists of threads of three different colors it is not always *one* continuous string) from below upwards in such a way as to secure two sheds, as shown in the diagram, Fig. 56.

Every turn of the warp passes over the sticks *a* and *b*; but it is alternate turns that pass over *c* and *d*. When the warp is laid she ties a

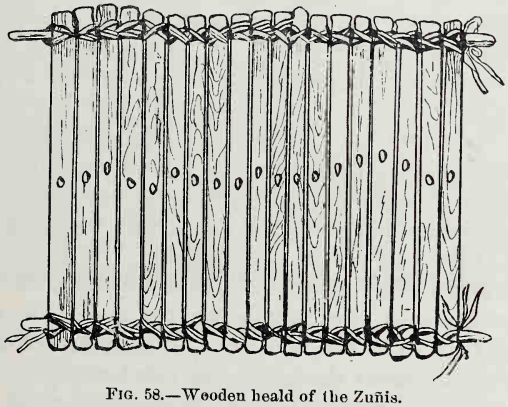


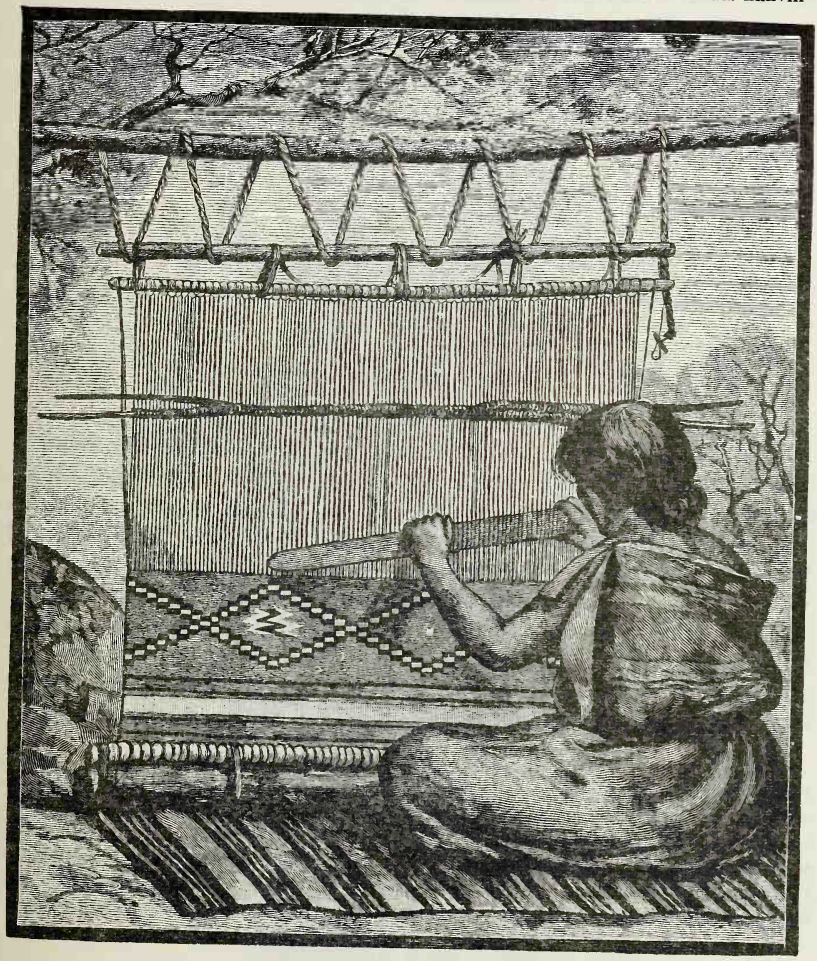
FIG. 58.—Wooden heald of the Zuñis.

string around the intersection of the sheds at *e*, so as to keep the sheds separate while she is mounting the warp on the beams. She then places the upper beam of the loom in the place of the stick *b* and the lower beam in the place of the stick *a*. Sometimes the upper and lower beams are secured to the two side rails forming a frame such as the warp of a

blanket is wound on (§ IV), but more commonly the loom is arranged in the manner shown in Plate XXXVI; that is, the upper beam is secured to a rafter, post, or tree, while to the lower beam is attached a loop of rope that passes under the thighs of the weaver, and the warp is rendered tense by her weight. Next, the upper shed is supplied with a shed-rod and the lower shed with a set of healds. Then the stick at *f* (upper stick in Plate XXXVI) is put in; this is simply a round stick, about which one loop of each thread of the warp is thrown. (Although the warp may consist of only one thread I must now speak of each turn as a separate thread.) Its use is to keep the different threads in place and prevent them from crossing and straggling; for it must be remembered that the warp in this case is not secured at two points between three stranded cords as is the blanket warp.

When this is all ready the insertion of the weft begins. The reed-fork is rarely needed and the batten used is much shorter than that employed in making blankets. Fig. 57 represents a section of a belt. It will be seen that the center is ornamented with peculiar raised figures; these are made by inserting a slender stick into the warp, so as to hold up certain of the threads while the weft is passed twice or oftener underneath them. It is practically a variety of damask or two-ply weaving; the figures on the opposite side of the belt being different. There is a limited variety of these figures. I think I have seen about a dozen different kinds. The experienced weaver is so well acquainted with the "count" or arrangements of the raised threads appropriate to each pattern that she goes on inserting and withdrawing the slender stick referred to without a moment's hesitation, making the web at the rate of 10 or 12 inches an hour. When the web has grown to the point at which she cannot weave it further without bringing the unfilled warp nearer to her, she is not obliged to resort to the clumsy method used with blankets. She merely seizes the anterior layer of the warp and pulls it down towards her; for the warp is not attached to the beams, but is movable on them; in other words, while still on the loom the belt is endless. When all the warp has been filled except about one foot, the weaving is completed; for then the unfilled warp is cut in the center and becomes the terminal fringes of the now finished belt.

The only marked difference that I have observed between the mechanical appliances of the Navajo weaver and those of her Pueblo neighbor is to be seen in the belt loom. The Zuñi woman lays out her warp, not as a continuous thread around two beams, but as several disunited threads. She attaches one end of these to a fixed object, usually a rafter in her dwelling, and the other to the belt she wears around her body. She has a set of wooden healds by which she actuates the alternate threads of the warp. Instead of using the slender stick of the Navajos to elevate the threads of the warp in forming her figures, she lifts these threads with her fingers. This is an easy matter with her



BRINGING DOWN THE BATTEN.

style of loom; but it would be a very difficult task with that of the Navajos. Plate XXXVII represents a Zuñi woman weaving a belt. The wooden healds are shown, and again, enlarged, in Fig. 58. The Zuñi women weave all their long, narrow webs according to the same system; but Mr. Bandelier has informed me that the Indians of the Pueblo of Cochiti make the narrow garters and hair-bands after the manner of the Zuñis, and the broad belts after the manner of the Navajos.

§ XI. I will close by inviting the reader to compare Plate XXXVI and Fig. 59. The former shows a Navajo woman weaving a belt; the

FIG. 59.—Girl weaving (from an Aztec picture).

latter a girl of ancient Mexico weaving a web of some other description. The one is from a photograph taken from life; the other I have copied from Tylor's "Anthropology" (p. 248); but it appears earlier in the copy of Codex Vaticana in Lord Kingsborough's "Antiquities of Mexico." The way in which the warp is held down and made tense, by a rope or band secured to the lower beam and sat upon by the weaver, is the same in both cases. And it seems that the artist who drew the original rude sketch sought to represent the girl, not as working "the cross-thread of the woof in and out on a stick," but as manipulating the reed-fork with one hand and grasping the heald-rod and shed-rod in the other.

NOTE.—The engravings were prepared while the author was in New Mexico and could not be submitted for his inspection until the paper was ready for the press. Some alterations were made from the original pictures. The following are the most important to be noted: In Plate XXXVIII the batten should appear held horizontally, not obliquely. Fig. 5 is reduced and cannot fairly delineate the gradations in color and regular sharp outlines of the finely-serrated figures. Fig, 53 does not convey the fact that the stripes are of uniform width and all the right-angles accurately made.

MEDICINE LODGE, VIEWED FROM THE EAST.

ILLUSTRATIONS.

PLATE XVI.—Objects in silver
XVII.—Navajo workshop
XVIII.—Crucible, and Sandstone molds for shaping silver objects
XIX.—Objects in silver
XX.—Navajo Indian with silver ornaments

NAVAJO SILVERSMITHS.

By Washington Matthews.

Among the Navajo Indians there are many smiths, who sometimes forge iron and brass, but who work chiefly in silver. When and how the art of working metals was introduced among them I have not been able to determine; but there are many reasons for supposing that they have long possessed it; many believe that they are not indebted to the Europeans for it. Doubtless the tools obtained from American and Mexican traders have influenced their art. Old white residents of the Navajo country tell me that the art has improved greatly within their recollection; that the ornaments made fifteen years ago do not compare favorably with those made at the present time; and they attribute this change largely to the recent introduction of fine files and emery-paper. At the time of the Conquest the so-called civilized tribes of Mexico had attained considerable skill in the working of metal, and it has been inferred that in the same period the sedentary tribes of New Mexico also wrought at the forge. From either of these sources the first smiths among the Navajos may have learned their trade; but those who have seen the beautiful gold ornaments made by the rude Indians of British Columbia and Alaska, many of whom are allied in language to the Navajos, may doubt that the latter derived their art from a people higher in culture than themselves.

The appliances and processes of the smith are much the same among the Navajos as among the Pueblo Indians. But the Pueblo artisan, living in a spacious house, builds a permanent forge on a frame at such a height that he can work standing, while his less fortunate Navajo *confrère*, dwelling in a low hut or shelter, which he may abandon any day, constructs a temporary forge on the ground in the manner hereafter described. Notwithstanding the greater disadvantages under which the latter labors, the ornaments made by his hand are generally conceded to be equal or even superior to those made by the Pueblo Indian.

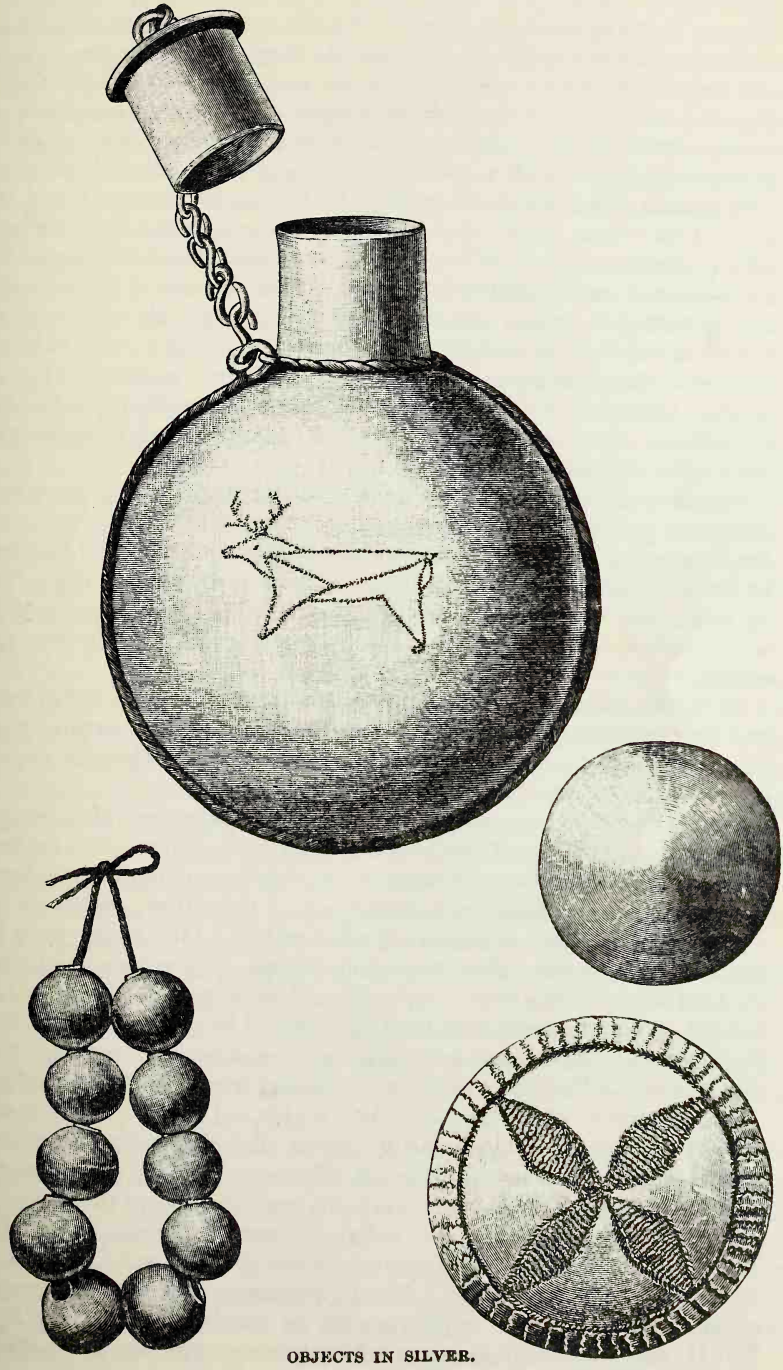
A large majority of these savage smiths make only such simple articles as buttons, rosettes, and bracelets; those who make the more elaborate articles, such as powder-chargers, round beads (Pl. XVI), tobacco cases, belts, and bridle ornaments, are few. Tobacco cases, made in the shape of an army canteen, such as that represented in

Fig. 6, are made by only three or four men in the tribe, and the design is of very recent origin.

Their tools and materials are few and simple; and rude as the results of their labor may appear, it is surprising that they do so well with such imperfect appliances, which usually consist of the following articles: A forge, a bellows, an anvil, crucibles, molds, tongs, scissors, pliers, files, awls, cold-chisels, matrix and die for molding buttons, wooden implement used in grinding buttons, wooden stake, basin, charcoal, tools and materials for soldering (blow-pipe, braid of cotton rags soaked in grease, wire, and borax), materials for polishing (sand-paper, emery-paper, powdered sandstone, sand, ashes, and solid stone), and materials for whitening (a native mineral substance—almogen—salt and water). Fig. 1, taken from a photograph, represents the complete shop of a silversmith, which was set up temporarily in a summer lodge or *hogan*, near Fort Wingate. Fragments of boards, picked up around the fort, were used, in part, in the construction of the *hogan*, an old raisin-box was made to serve as the curb or frame of the forge, and these things detracted somewhat from the aboriginal aspect of the place.

A forge built in an outhouse on my own premises by an Indian silversmith, whom I employed to work where I could constantly observe him, was twenty-three inches long, sixteen inches broad, five inches in height to the edge of the fire-place, and the latter, which was bowl-shaped, was eight inches in diameter and three inches deep. No other Navajo forge that I have seen differed materially in size or shape from this. The Indian thus constructed it: In the first place, he obtained a few straight sticks—four would have sufficed—and laid them on the ground to form a frame or curb; then he prepared some mud, with which he filled the frame, and which he piled up two inches above the latter, leaving the depression for the fire-place. Before the structure of mud was completed he laid in it the wooden nozzle of the bellows, where it was to remain, with one end about six inches from the fire-place, and the other end projecting about the same distance beyond the frame; then he stuck into the nozzle a round piece of wood, which reached from the nozzle to the fire-place, and when the mud work was finished the stick was withdrawn, leaving an uninflammable tweer. When the structure of mud was completed a flat rock about four inches thick was laid on at the head of the forge—the end next to the bellows—to form a back to the fire, and lastly the bellows was tied on to the nozzle, which, as mentioned above, was built into the forge, with a portion projecting to receive the bellows. The task of constructing this forge did not occupy more than an hour.

A bellows, of the kind most commonly used, consists of a tube or bag of goatskin, about twelve inches in length and about ten inches in diameter, tied at one end to its nozzle and nailed at the other to a circular disk of wood, in which is the valve. This disk has two arms: one above for a handle and the other below for a support. Two or more



OBJECTS IN SILVER.

rings or hoops of wood are placed in the skin-tube to keep it distended, while the tube is constricted between the hoops with buckskin thongs, and thus divided into a number of compartments, as shown in Pl. XVII. The nozzle is made of four pieces of wood tied together and rounded on the outside so as to form a cylinder about ten inches long and three inches in diameter, with a quadrangular hole in the center about one inch square. The bellows is worked by horizontal movements of the arm. I have seen among the Navajos one double-chambered bellows with a sheet-iron tweer. This bellows was about the same size as the single chambered one described above. It was also moved horizontally, and by means of an iron rod passing from one end to the other and attached to the disks, one chamber was opened at the same time that the other was closed, and *vice versa*. This gave a more constant current of air than the single-chambered implement, but not as steady a blast as the bellows of our blacksmiths. Such a bellows, too, I have seen in the Pueblo of Zuñi.

For an anvil they usually use any suitable piece of iron they may happen to pick up, as for instance an old wedge or a large bolt, such as the king-bolt of a wagon. A wedge or other large fragment of iron may be stuck in the ground to steady it. A bolt is maintained in position by being driven into a log. Hard stones are still sometimes used for anvils and perhaps they were, at one time, the only anvils they possessed.

Crucibles are made by the more careful smiths of clay, baked hard, and they are nearly the same shape as those used by our metallurgists, having three-cornered edges and rounded bottoms. They are usually about two inches in every dimension.

Fig. 1, Pl. XVIII represents one of ordinary shape and size, which I have in my collection. The Navajos are not good potters; their earthenware being limited to these crucibles and a few unornamented water-jars; and it is probably in consequence of their inexperience in the ceramic art that their crucibles are not durable. After being put in the fire two or three times they swell and become very porous, and when used for a longer time they often crack and fall to pieces. Some smiths, instead of making crucibles, melt their metal in suitable fragments of Pueblo pottery, which may be picked up around ruins in many localities throughout the Navajo country or purchased from the Pueblo Indians.

The moulds in which they cast their ingots, cut in soft sandstone with a home-made chisel, are so easily formed that the smith leaves them behind when he moves his residence. Each mould is cut approximately in the shape of the article which is to be wrought out of the ingot cast in it, and it is greased with suet before the metal is poured in. In Figs. 2 and 3, Pl. XVIII, are represented pieces of sand-stone, graven for molds, now in my possession. The figures are one-third the dimensions of the subjects. In the middle cavity or mould shown in Fig. 2, Pl. XVIII, was cast the ingot from which was wrought the arrow-shaped

handle of the powder-charger shown in Pl. XIX; in the lower cavity depicted in the same figure was moulded the piece from which the bowl of this charger was formed. The circular depression, delineated in the lower right corner of Fig. 3, Pl. XVIII, gave form to the ingot from which the sides of the canteen-shaped tobacco-case (Fig. 6) was made.

Tongs are often made by the Navajo silversmiths. One of these which I saw had a U-shaped spring joint, and the ends were bent at right angles downwards, so as more effectually to grasp the flat-sided crucible. Often nippers or scissors are used as tongs.

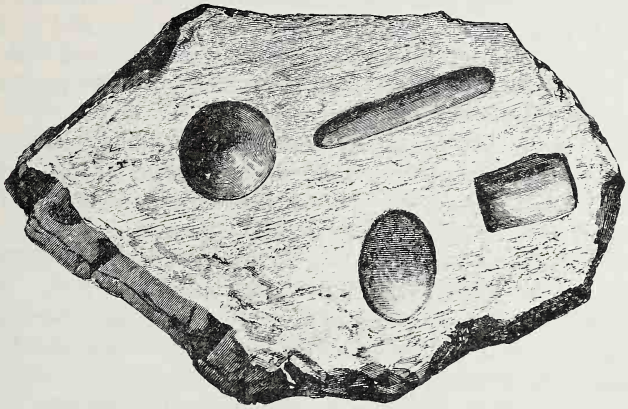
Ordinary scissors, purchased from the whites, are used for cutting their metal after it is wrought into thin plates. The metal saw and metal shears do not seem as yet to have been imported for their benefit. Some of the more poorly provided smiths use their scissors also for tongs, regardless or ignorant of consequences, and when the shears lose their temper and become loose-jointed and blunt, the efforts of the Indian to cut a rather thick plate of silver are curious to see. Often, then, one or two bystanders are called to hold the plate in a horizontal position, and perhaps another will be asked to hold the points of the scissors to keep them from spreading. Scissors are sometimes used as dividers, by being spread to the desired distance and held in position by being grasped in the hand. By this means I have seen them attempt to find centers, but not to describe circles. It is probable that had they trusted to the eye they might have found their centers as well.

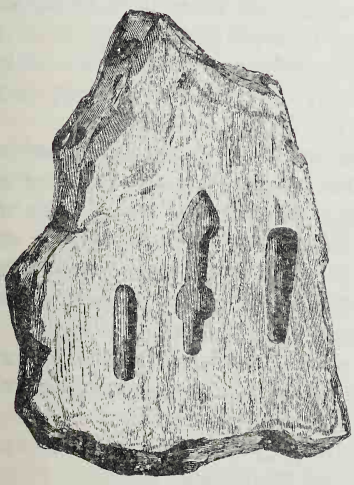
Their iron pliers, hammers, and files they purchase from the whites. Pliers, both flat-pointed and round-pointed, are used as with us. Of files they usually employ only small sizes, and the varieties they prefer are the flat, triangular, and rat-tail. Files are used not only for their legitimate purposes, as with us, but the shanks serve for punches and the points for gravers, with which figures are engraved on silver.

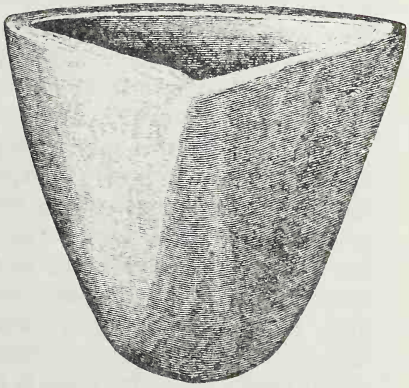
The Indians usually make their own cold-chisels. These are not used where the scissors and file can be conveniently and economically employed. The re-entrant rectangles on the bracelet represented in Fig. 4, Pl. XIX, were cut with a cold-chisel and finished with a file.

Awls are used to mark figures on the silver. Often they cut out of paper a pattern, which they lay on the silver, tracing the outline with an awl. These tools are sometimes purchased and sometimes made by the Indians. I have seen one made from a broken knife which had been picked up around the fort. The blade had been ground down to a point.

Metallic hemispheres for beads and buttons are made in a concave matrix by means of a round-pointed bolt which I will call a die. These tools are always made by the Indians. On one bar of iron there may be many matrices of different sizes; only one die fitting the smallest concavity, is required to work the metal in all. In the picture of the smithy (Pl. XVII, in the right lower corner beside the tin-plate), a piece of an old horse-shoe may be seen in which a few matrices have been worked, and, beside it, the die used in connection with the matrices.







CRUCIBLE, AND SANDSTONE MOLDS FOR SHAPING SILVER OBJECTS.

A little instrument employed in levelling the edges of the metallic hemispheres, is rude but effective. In one end of a cylinder of wood, about three or four inches long, is cut a small roundish cavity of such a size that it will hold the hemisphere tightly, but allow the uneven edges to project. The hemisphere is placed in this, and then rubbed on a flat piece of sandstone until the edges are worn level with the base of the wooden cylinder. The uses of the basin and the wooden stake are described further on.

Their method of preparing charcoal is much more expeditious than that usually employed by our charcoal-burners, but more wasteful; wood, however, need not yet be economized on the juniper-covered *mesas* of New Mexico. They build a large fire of dry juniper, and when it has ceased to flame and is reduced to a mass of glowing coals, they smother it well with earth and leave it to cool. If the fire is kindled at sunset, the charcoal is ready for use next morning.

The smith makes his own blow-pipe, out of brass, usually by beating a piece of thick brass wire into a flat strip, and then bending this into a tube. The pipe is about a foot long, slightly tapering and curved at one end; there is no arrangement for retaining the moisture proceeding from the mouth. These Indians do not understand our method of making an air chamber of the mouth; they blow with undistended cheeks, hence the current of air directed on the flame is intermitting. The flame used in soldering with the blow-pipe is derived from a thick braid of cotton rags soaked in mutton suet or other grease. Their borax is purchased from the whites, and from the same source is derived the fine wire with which they bind together the parts to be soldered. I have been told by reliable persons that it is not many years since the Navajos employed a flux mined by themselves in their own country; but, finding the pure borax introduced by the traders to be much better, they gradually abandoned the use of the former substance.

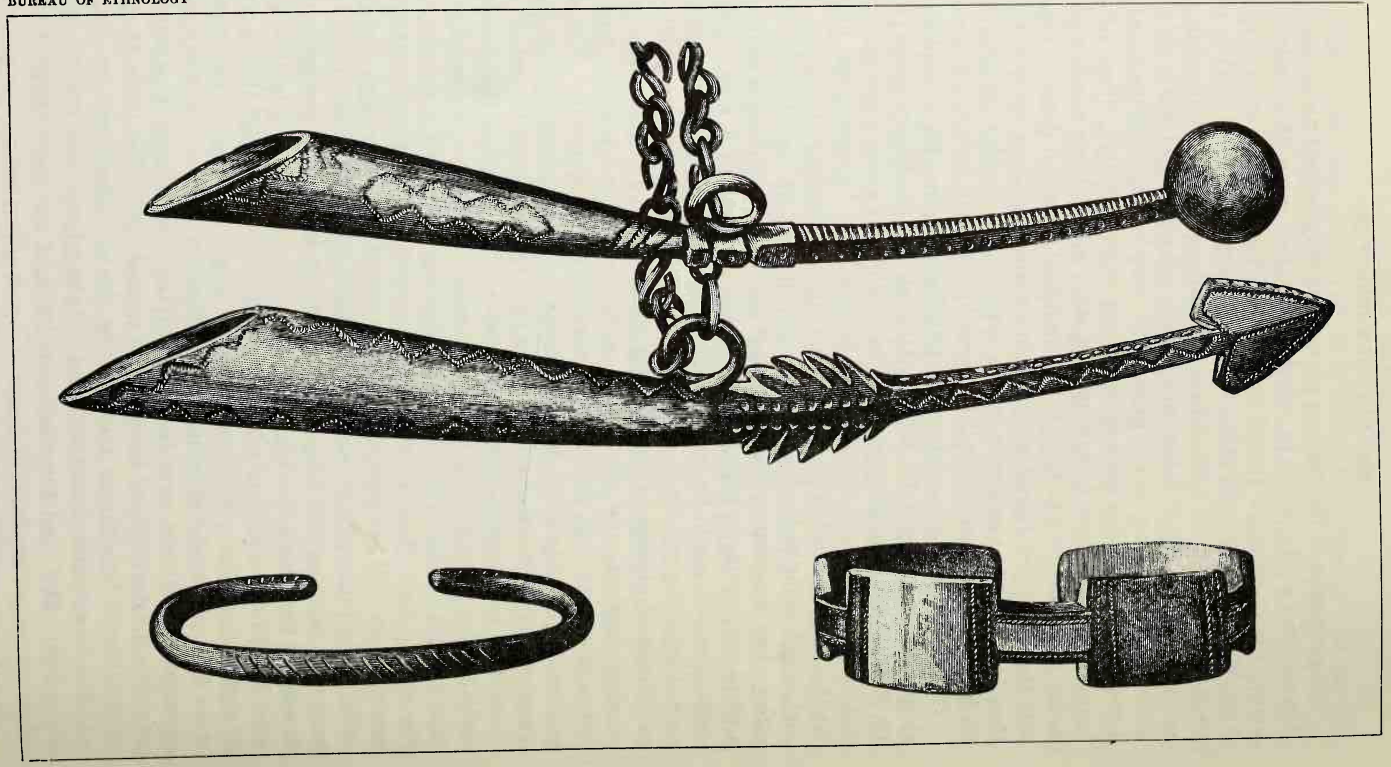
For polishing, they have sand-paper and emery-paper purchased from the whites; but as these are expensive, they are usually required only for the finishing touches, the first part of the work being done with powdered sandstone, sand, or ashes, all of which are used with or without water. At certain stages in the progress of the work, some articles are rubbed on a piece of sandstone to reduce the surfaces to smoothness; but the stone, in this instance, is more a substitute for the file than for the sand-paper. Perhaps I should say that the file is a substitute for the stone, for there is little doubt that stone, sand, and ashes preceded file and paper in the shop of the Indian smith.

For blanching the silver, when the forging is done, they use a mineral substance found in various parts of their country, which, I am informed by Mr. Taylor, of the Smithsonian Institution, is a "hydrous sulphate of alumina," called almogen. This they dissolve in water, in a metal basin, with the addition, sometimes, of salt. The silver, being first slightly heated in the forge, is boiled in this solution and in a short time becomes very white.

The processes of the Navajo silversmith may be best understood from descriptions of the ways in which he makes some of his silver ornament. I once engaged two of the best workmen in the tribe to come to Fort Wingate and work under my observation for a week. They put up their forge in a small outbuilding at night, and early next morning they were at work. Their labor was almost all performed while they were sitting or crouching on the ground in very constrained positions; yet I never saw men who worked harder or more steadily. They often labored from twelve to fifteen hours a day, eating their meals with dispatch and returning to their toil the moment they had done. Occasionally they stopped to roll a cigarette or consult about their work, but they lost very few moments in this way. They worked by the job and their prices were such that they earned about two dollars a day each.

The first thing they made was a powder charger with a handle in the shape of a dart (Fig. 2, Pl. XIX). Having cut in sandstone rock (Fig. 2, Pl. XVIII) the necessary grooves for molds and greased the same, they melted two Mexican dollars—one for the bowl or receptacle, and one for the handle—and poured each one into its appropriate mold. Then each smith went to work on a separate part; but they helped one another when necessary. The ingot cast for the receptacle was beaten into a plate (triangular in shape, with obtuse corners), of a size which the smith guessed would be large enough for his purpose. Before the process of bending was quite completed the margins that were to form the seam were straightened by clipping and filing so as to assume a pretty accurate contact, and when the bending was done, a small gap still left in the seam was filled with a shred of silver beaten in. The cone, at this stage, being indented and irregular, the workman thrust into it a conical stake or mandrel, which he had formed carefully out of hard wood, and with gentle taps of the hammer soon made the cone even and shapely. Next, withdrawing the stake, he laid on the seam a mixture of borax and minute clippings of silver moistened with saliva, put the article into the fire, seam up, blew with the bellows until the silver was at a dull red-heat, and then applied the blow-pipe and flame until the soldering was completed. In the meantime the other smith had, with hammer and file, wrought the handle until it was sufficiently formed to be joined to the receptacle, the base of the handle being filed down for a length of about a quarter of an inch so that it would fit tightly into the orifice at the apex of the receptacle. The two parts were then adjusted and bound firmly together with a fine wire passing in various directions, over the base of the cone, across the protuberances on the dart-shaped handle, and around both. This done, the parts were soldered together in the manner already described, the ring by which it is suspended was fastened on, the edge of the receptacle wa clipped and filed, and the whole was brought into good shape with file, sand, emery-paper, &c.

The chasing was the next process. To make the round indentations on



OBJECTS IN SILVER.

the handle, one smith held the article on the anvil while the other applied the point of the shank of a file—previously rounded—and struck the file with a hammer. The other figures were made with the sharpened point of a file, pushed forward with a zigzag motion of the hand. When the chasing was done the silver was blanched by the process before referred to, being occasionally taken from the boiling solution of almogen to be rubbed with ashes and sand. For about five hours both of the smiths worked together on this powder-charger; subsequently, for about three hours' more, there was only one man engaged on it; so that, in all, thirteen hours labor was spent in constructing it. Of this time, about ten hours were consumed in forging, about one and one-half hours in filing and rubbing, and about the same time in ornamenting and cleaning.

In making the hollow silver beads they did not melt the silver, but beat out a Mexican dollar until it was of the proper tenuity—frequently annealing it in the forge as the work advanced. When the plate was ready they carefully described on it, with an awl, a figure (which, by courtesy, we will call a circle) that they conjectured would include a disk large enough to make half a bead of the required size. The disk was then cut out with scissors, trimmed, and used as a pattern to cut other circular pieces by. One of the smiths proceeded to cut out the rest of the planchets, while his partner formed them into hollow hemispheres with his matrix and die. He did not put them at once into the cavity from which they were to get their final shape, but first worked them a little in one or more larger cavities, so as to bring them gradually to the desired form. Next the hemispheres were leveled at the edges by a method already described, and subsequently perforated by holding them, convex surface downwards, on a piece of wood, and driving through them the shank of a file with blows of a hammer. By this means of boring, a neck was left projecting from the hole, which was not filed off until the soldering was done. The hemispheres were now strung or, I may say, spitted on a stout wire in pairs forming globes. The wire or spit referred to was bent at one end and supplied with a washer to keep the beads from slipping off, and all the pieces being pressed closely together were secured in position by many wraps of finer wire at the other end of the spit. The mixture of borax, saliva, and silver was next applied to the seams of all the beads; they were put into the fire and all soldered at one operation. When taken from the fire they were finished by filing, polishing and blanching.

These Indians are quite fertile in design. In Pl. XIX are shown two powder-chargers, which I consider very graceful in form. I have seen many of these powder-chargers, all very graceful, but no two alike except in cases where duplicates had been specially ordered. Their designs upon bracelets and rings are of great variety. Ornaments for bridles, consisting of broad bands of silver, sufficient in size and number to almost entirely conceal the leather, are not particularly handsome, but

are greatly in demand among the Navajos and are extensively manufactured by them. Leather belts studded with large plates of silver are favorite articles of apparel, and often contain metal to the value of forty or fifty dollars. Pl. XX represents an Indian wearing such a belt, in which only three of the plates are shown. Single and double crosses of silver are represented attached to his necklace. The cross is much worn by the Navajos, among whom, I understand, it is not intended to represent the "Cross of Christ," but is a symbol of the morning star. The lengthening of the lower limb, however, is probably copied from the usual form of the Christian emblem. These savage smiths also display much ingenuity in working from models and from drawings of objects entirely new to them.

They are very wasteful of material. They usually preserve the clippings and melt them in the crucible, or use them in soldering; but they make no attempt to save the metal carried off in filing, polishing, and by oxidizing in the forge, all of which is considerable. In one article of silver, for which, allowing for clippings saved, 836 grains were given to the smith, and the work on which I watched so closely throughout that I am certain none of the material was stolen, there was a loss of 120 grains, or over 14 per cent.

The smiths whom I have seen working had no dividers, square, measure, or any instrument of precision. As before stated, I have seen scissors used as compasses, but as a rule they find approximate centers with the eye, and cut all shapes and engrave all figures by the unaided guidance of this unreliable organ. Often they cut out their designs in paper first and from them mark off patterns on the metal. Even in the matter of cutting patterns they do not seem to know the simple device of doubling the paper in order to secure lateral uniformity.

Here ends my description of the smithcraft of a rude but docile and progressive people. I trust that it may serve not only to illustrate some aspects of their mental condition, their inventive and imitative talents, but possibly to shed some light on the condition and diffusion of the art of the metalist in the prehistoric days of our continent, notwithstanding the fact that some elements of their craft are of recent introduction and others of doubtful origin.

NAVAJO INDIAN WITH SILVER ORNAMENTS.